

WASHINGTON

SCIENCE TRENDS

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* GAS BEARING SYSTEM

The Jet Propulsion Laboratory has reported to the National Aeronautics and Space Administration that a closed-cycle system for gas bearings is feasible for a number of spacecraft applications.

✓ Advantages: "Considerable inherent advantages" are envisioned by JPL researchers through the support of sensing masses of inertial instruments by gas lubrication and flotation. Among these are the virtual elimination of friction, drifts and mass shifts.

✓ Requirement: For short duration missions, such as missile or booster applications, the required supply of compressed gas can be readily stored in suitable containers in the vehicle. For long duration space missions, however, storage becomes impractical because of container size and weight -- making necessary the consideration of a closed-cycle system in which the gas is recirculated.

✓ Energy Sources: Proper selection of power sources for operation of the system is of prime importance, according to these studies. Direct use of thermal energy, without conversion to electrical and mechanical power is preferred, and JPL has constructed and tested a thermally-pumped system with this in mind.

✓ Experimental System: The system developed for the NASA consists of an evaporator in which a suitable fluid, such as Freon, is vaporized and raised to the required operating pressure, a pressure regulator keeps the pressure at a set value, and a superheater raises the temperature sufficiently above the dew point to avoid condensation at the temperature of the gas bearing. After passing through the bearing the fluid can be condensed by exposing it to the dark side of a spacecraft. The liquid can be returned to the evaporator by a miniature mechanical pump or by capillary action.

✓ Recommendation: NASA has been advised that a closed-cycle system is "quite feasible" for lunar or planetary missions. The thermal pumping power can be obtained directly from solar radiation in panels or concentrators or from nuclear reactors, if and when available.

NAVY SEEKS SALINITY DETECTOR: The Navy Bureau of Ships, Hull Machinery Branch, Washington 25, D. C. hopes to have developed a salinity detector to help prevent recurrent hydraulic system breakdowns in submarines caused by salt water contamination. The device should be capable of determining, to an accuracy of 0.1 percent, whether the hydraulic oil contains even a trace of salt water. This would permit corrective action to be taken before the system becomes corroded. The same office is also studying means for reclaiming salt water contaminated oils, in the hope that reuse will offset the high cost of cleaning and flushing a contaminated hydraulic system.

* RADIOACTIVE GASES TRACE PETROLEUM RESERVOIRS

The U. S. Bureau of Mines reports "completely satisfactory" results in the use of techniques and instruments for determining flow paths through certain petroleum reservoirs with radioactive inert-gas tracers.

In field studies, detection and injection units operated continuously for extended periods of time with only slight attention and minimum maintenance.

Survey demonstrated, according to the Bureau:

✓ Radioactive inert gases such as krypton-85 or xenon-133 can be used to trace the flow of fluids in reservoirs with minimum loss through solution in reservoir fluids.

✓ Chemical reactions and adsorption presented no particular problem.

✓ Tracer gas can be proportioned in natural gas with adequate accuracy by using simple and readily available commercial units.

✓ Radioactive tracers which emit beta particles with suitable energies can be monitored continuously with simple, reliable and inexpensive instruments.

✓ Inert radioactive gases should be useful in tracing reactions and flow in other stimulative production methods, such as pressure maintenance by gas injection, miscible-phase or solvent injection, or in-place combustion.

(Details available in Report of Investigations No. 5733. Single copies free from Publication-Distribution Section, U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa.)

* GOVERNMENT RESEARCH REPORTS

The following selective bibliographies listing U. S. Government research reports, translations and other technical documents available to science and industry may now be obtained (at 10 cents each) from OTS, U. S. Department of Commerce, Washington 25, D. C.:

- SB 418 -- Solar Energy Applications
- SB 442 -- Chinese Mainland Science and Technology
- SB 443 -- Tranquilizers and Stimulants
- SB 448 -- Air Pollution and Purification
- SB 451 -- Low Temperature Research on Materials
- SB 452 -- High Temperature Metallurgy and Heat Resistant Alloys
- SB 453 -- High Temperature Research
- SB 454 -- Heat Treatment of Metals
- SB 455 -- Bioastronautics
- SB 456 -- Boron and Its Compounds
- SB 457 -- Cobalt
- SB 458 -- Copper
- SB 460 -- Metalworking, Part I, Machining
- SB 462 -- Metalworking, Part III, Casting and Forging
- SB 463 -- Metalworking, Part IV, Rolling, Drawing and Extrusion
- SB 465 -- Nickel

TECHNICAL TRENDS

- The U. S. Naval Ordnance Laboratory, White Oak, Silver Spring, Md. is looking for organizations with experience in the study of compressive strength properties of filament wound reinforced plastics. The objective is improvement of external pressure vessel systems. ✓✓✓ The Air Force is interested in development of a highly accurate distance-measuring subsystem to operate in the microwave band for improved air mapping and survey missions. An airborne interrogator and ground transponders are included. ✓✓✓ The General Electric Co. has received a Navy Department contract for development of an advanced solid electrolyte tantalum capacitor capable of operating at 100 volts at 85°C. ✓✓✓ Budd Electronics, Long Island City, N. Y. has been awarded a Navy contract for development of electron tube liquid coolers for shipboard installation.
- A report on Magnesium Compounds for 1960 (Mineral Market Survey No. 3245) is available from the Branch of Nonferrous Metals, Division of Minerals, U. S. Bureau of Mines, Washington 25, D. C. ✓✓✓ The Navy is buying a "fleet" of yard-long submarine target simulators which can be launched from ships and helicopters and even through a large submarine's torpedo tubes. The devices maneuver, dive and turn as submarines do, and also send out engine noises and sonar signals to aid in training missions. ✓✓✓ New Commercial Standards for certain Polyethylene sheeting (TS-5534) are available on request from the Commodity Standards Division, OTS, U. S. Department of Commerce, Washington 25, D. C. ✓✓✓ Pratt and Whitney, Middletown, Conn. will build a test stand at the NASA Lewis Research Center, Cleveland for development of space radiators and condensers expected to be required for space electrical power systems. ✓✓✓ The Office of Public Information, NASA, 1520 H Street, N. W., Washington 25, D. C. has available Release No. 61-143 outlining U. S. policies for cooperation with other nations in space research.
- A report determining that a minimum wage of \$1.23 per hour prevails in the Electronic Component Parts Industry is available from the Wage and Hour and Public Contracts Division, U. S. Department of Labor, Washington 25, D. C. ✓✓✓ Bid forms on available quantities of rhodium sponge and powder, an important element in electroplating, as a catalyst and in equipment used by the glass industry to extrude fibers, can be obtained from the Project Administration Division, Room 6030, GSA Building, Washington 25, D. C. ✓✓✓ A report showing that West Germany is becoming an increasingly important factor in the world business machine industry is available (as BD-61-116) from the Business Equipment Division, U. S. Department of Commerce, BDSA, Washington 25, D. C. ✓✓✓ The Electronics Division of the same agency has available BD-61-115 outlining increased shipments of electronic components by U. S. Manufacturers.
- The Army wants its wheeled vehicles to have a 90 percent probability of going 20,000 miles before components have to be rebuilt. The best the Army gets at present is a 42 percent probability and the worst is a zero probability of reaching 10,000 miles. ✓✓✓ The National Science Foundation has now published its report on future science/engineering growth (SCIENCE TRENDS, June 5, 1961). Free copies of the report, "Investing in Scientific Progress" are available upon request to Publications Office, National Science Foundation, Washington 25, D. C. ✓✓✓ The Department of State has appointed O. A. Hougen, Professor of Chemical Engineering, University of Wisconsin as Scientific Attache, American Embassy, Sweden and W. W. Greulich, Professor of Anatomy, Stanford University as Scientific Attache, American Embassy, London.
- Information on the inspection and testing of high efficiency particulate filter units for the Atomic Energy Program for Fiscal 1962 is now available from the Industrial and Fire Protection Branch, Office of Operational Safety, U. S. Atomic Energy Commission, Washington 25, D. C. ✓✓✓ Studies showing that average octane ratings for domestic motor gasolines apparently have leveled off are available as Petroleum Products Survey No. 20 from U. S. Bureau of Mines Publication-Distribution Section, 4800 Forbes Avenue, Pittsburgh 13, Pa.

RESEARCH CHECKLIST

- POLYSTYRENE CONTAINERS: The Army is testing the feasibility of using shipping containers manufactured from expanded polystyrene beads as a replacement for standard fiberboard or wooden boxes. Tests thus far indicate that such containers are lighter, easier to pack, water-proof, and rugged. The container is made from two separate aluminum molds. Polystyrene beads are fed into the mold by vacuum and then subjected to the required steam pressure to expand and fuze the beads compactly. The container is removed from the mold, fastened with either metal strapping or reinforced filament tape and is then ready for use. Current tests employ containers for small horsepower military engines.

(Technique developed by Packaging Development Branch, U. S. Army Engineer Research and Development Laboratories, Ft. Belvoir, Va.)

- INFRARED TRAFFIC SURVEYS: Studies by the Texas Transportation Institute indicate that a photoelectromagnetic detector may be a practical means of counting vehicles in a traffic survey. The detector, placed in the roadbed, picks up infrared rays from the heated underside of a moving automobile. Extensive road testing is said to be required however, to determine response to various types of vehicles at various speeds, and to eliminate the effects of atmospheric and road conditions.

(Study by W. F. Mundkowsky, Transportation Institute, Texas A. and M. College, College Station, Tex.)

- VACUUM MELTING LOW-ALLOY STEEL: Studies by the U. S. Bureau of Mines have confirmed that vacuum melting substantially refines low alloy steels through elimination of undesirable metallic and non-metallic elements. Vacuum melting, a relatively old process, has only recently come into extensive use for refining large quantities of metals and alloys. The process eliminates approximately 80 percent of the nitrogen and 90 percent of the oxygen, as well as most of the undesirable metallic trace impurities.

(Report available. Single Copies Free. Write U. S. Bureau of Mines, Publication-Distribution Center, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Report of Investigation No. 5778)

- RECORDING AIRCREW CONVERSATIONS: The Federal Aviation Agency has released to the public its technical studies which led to the conclusion that recording of crew conversations in typical transport aircraft is feasible. An area pickup microphone with a cardioid pattern was found to be more satisfactory than individual pick-up mikes. A Krohn-Hite variable band-pass filter improved the intelligibility of the recorded conversations appreciably.

(FAA Final Report on Task D/E-1-6809 ((PB 171 505)) available through FAA channels or at 50 cents from OTS, U. S. Department of Commerce, Washington 25, D. C.)

- PORTABLE He³ REFRIGERATOR: The National Bureau of Standards has developed a portable He³ refrigerator capable of maintaining temperatures as low as 0.26° K for a wide variety of experiments, including magnetic and thermal measurements on paramagnetic substances, and nuclear orientation studies. The refrigerator is not the first of its general type, but is said to be particularly efficient and effective and to possess many novel features which permit simple construction and operation.

(For details of Portable He³ Refrigerator, write National Bureau of Standards, Office of Technical Information, Washington 25, D. C.)

- ION ENGINE PROGRESS: The National Aeronautics and Space Administration has developed a method of producing thin porous platelets of tungsten for ion-propulsion applications. Such systems develop thrust by the acceleration of ions through a large voltage gradient, but one of the main problem areas has been the method of producing propellant ions. One of the most promising techniques, it is reported, concerns the use of a porous plate that will allow a small flow of gaseous metal atoms to come in contact with an ionizing surface. The tungsten platelets were successfully produced and tested in an experimental engine, but "considerably more research" is required.

(Report available. 23 Pages. Single Copies Free. Write National Aeronautics and Space Administration, 1520 H Street, N. W., Washington 25, D.C., ATTN: CODE BID regarding NASA Technical Note D-864)

- BORON-BASE REFRACTORY: Studies by the U. S. Bureau of Mines indicate that a high-temperature refractory material based on a combination of boron, silica and magnesium may have a number of special applications. The composition was found to be resistant to high temperatures under oxidizing conditions, is stable in water, hydrochloric acid and hydrogen. It has a low density and a hardness value in the range of quartz, plus other assets. The composition bonds well with a number of materials such as granular zircon, boron carbide chips and stainless steel wire. But there are certain disadvantages, such as apparent brittleness, difficulty in shaping and a relatively low modulus of rupture compared with other cermets.

(Report available. Single Copies Free. Write U. S. Bureau of Mines, Publication-Distribution Section, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Report of Investigation No. 5774)

- MEASURING METAL SKIN TEMPERATURES: Studies for the Atomic Energy Commission by American-Standard, Mountain View, Calif. have demonstrated that special thermocouples can be accurately located at or near the surface of metal structures to permit the measurement of temperature distribution. Reliable positioning in steel bodies was achieved by using a special clamping procedure to prevent shifting of wires during the welding process. Special instrumentation was also developed for a Mach 5 test vehicle tail fin and special nose probes used for in-flight aerodynamic studies.

(Report SC-4464(RR) available through AEC channels or at \$1.50 from OTS, U. S. Department of Commerce, Washington 25, D. C.)

- PHASE ANGLE MASTER STANDARD: The National Bureau of Standards has designed and constructed a phase angle master standard said to be useful in solving computer design and missile guidance problems. The standard, for use at 400 cycles per second, is continuously variable from 0° to 180° with an accuracy of 0.01°. It is believed that similar standards for high audio frequencies could be designed but the upper limit in frequency would probably be about 20 kc. At higher frequencies, stray capacitance introduced by connecting and switching leads might prove troublesome, the Bureau states.

(Write National Bureau of Standards, Office of Technical Information, Washington 25, D. C. for further information on Phase Angle Master Standard)

- HIGH PRESSURE APPARATUS: The University of Utah, under an Air Force contract, has developed and tested a new apparatus for producing and measuring pressures to 20,000 atmospheres, using a liquid or gas environment. The pressure chamber has a working space 1 inch in diameter and 4 inches long and is designed for use with internal heating to 1000°C. A new type plug, incorporating a polyethylene seal, was also designed for this equipment, so that eight electrical leads could be brought into the pressure chamber.

(ARL Technical Report 60-330 ((PB 171 049)) available through Air Force channels or at \$1.25 from OTS, U. S. Department of Commerce, Washington 25, D. C.)

P U B L I C A T I O N C H E C K L I S T

All of the following publications are now available through military channels, or at the listed prices from OTS, U. S. Department of Commerce, Washington 25, D. C.

- POWER SUPPLIES, a bibliography with abstracts of all unclassified reports on fuel cells, missile power supplies, batteries, thermoelectricity, etc. collected by the Armed Services Technical Information Agency from 1953 through 1960. All the reports noted are available free to qualified defense contractors, while most will be available for sale to others. 310 Pages. \$5. (Ask for AD 249 100 ((PB 171 689)))
- POLYMERS RELATED TO CELLULOSE, an Army-sponsored British study on fabric improvement. 83 Pages. \$2.25. (Ask for PB 171 574)
- NITROGEN FLUORIDES, a literature review by Lockheed Corp. for the U. S. Government on certain compounds containing nitrogen-fluorine bonds of interest in liquid and solid propellant work and other fields. 32 Pages. \$1. (Ask for LMSD-703005 ((PB 171 252)))
- SUPEROXIDIZERS, a study by Olin Mathieson Chemical Corp. for the Air Force on higher oxides of hydrogen for potential application as new and improved oxidants for rocket propulsion. Includes a review of literature. 49 Pages. \$1.50. (Ask for AFMDC-TR-60-18 ((PB 171 255)))
- AIRCRAFT AIR CONDITIONING, a detailed Navy study of the feasibility of a light-weight air conditioner system for piston-driven aircraft in which air would be used as the refrigerant. 19 Pages. \$1. (Ask for NAMC-AEL-1675 ((PB 171 257)))
- FOOD WARMING UNITS FOR SPACE VEHICLES, a detailed report on the development and final design features of an electric and a solar-powered food warmer developed for the Air Force, which (officially) has no responsibility for feeding men in space vehicles. 69 Pages. \$1.75. (Ask for WADD Technical Report 60-620 ((PB 171 605)))
- THERMAL CHARACTERISTICS OF EXPLOSIVES, a comprehensive study for the Air Force by the Colorado School of Mines Research Foundation on the effect of heat upon physical and chemical properties of military explosives, chiefly TNT. 63 Pages. \$2.50. (Ask for AFSWC-TR-59-34 ((PB 171 256)))
- ROTOR BLADE PROTECTION, a report on Army attempts to develop improved methods of protecting helicopter blades from extreme environmental conditions. 24 Pages. \$1. (Ask for PB 171 514)
- AIRPORT DOPPLER, a technical report by Airborne Instruments Laboratory for the Federal Aviation Agency describing the development of a radio doppler detector as a boundary-crossing sensor for airport ground traffic control. The program also provided a display console. \$2. (Ask for Report FAA 5934-1 ((PB 171 509)))
- MAGNETIC PHASE CORRECTION CIRCUITS, a report from Yale University for the Air Force on the use of solid state and magnetic components for integration and differentiation of the modulation on suppressed-carrier signals. All the techniques developed make use of saturable magnetic cores. 130 Pages. \$2.75. (Ask for WADC Technical Report 59-237 ((PB 171 542)))
- NEW CONCEPTS FOR RADIO FREQUENCY TRANSMISSION LINES, a report from the University of Pennsylvania for the Air Force on new concepts of point-to-point transmission of radio frequency energy for general applications in air and space craft. This includes a modified Goubau line, an electrolytic transmission line and a magneto-ionic line. 64 Pages \$1.75. (Ask for WADD Technical Report 60-701 ((PB 171 557)))

